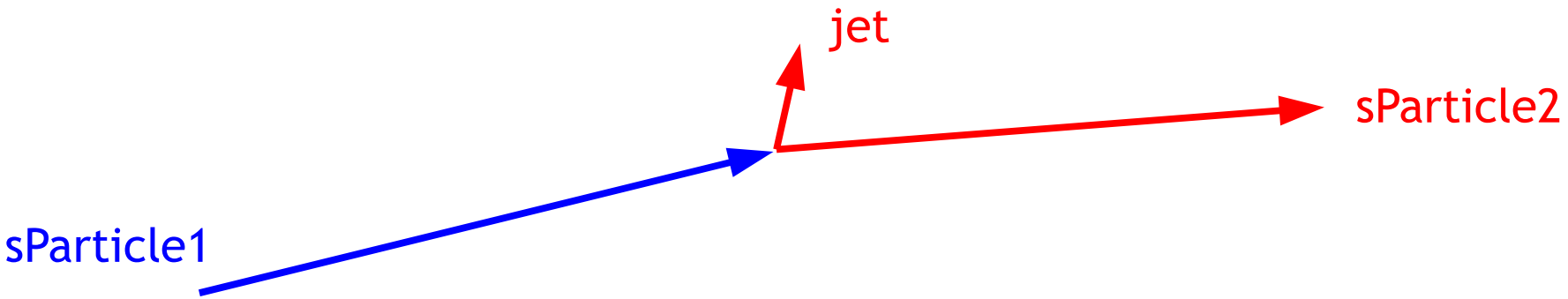
Update on Kinematic Fits

C. Sander

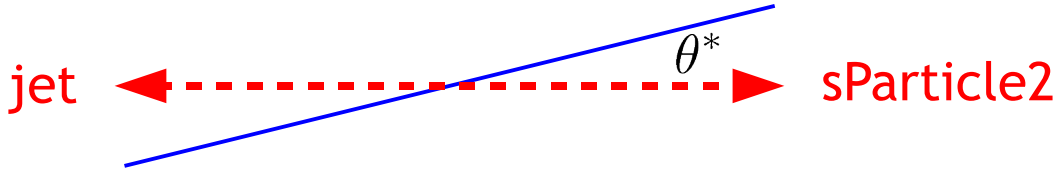
Susy Group Meeting – Hamburg – 23rd June 09

Angular Distributions

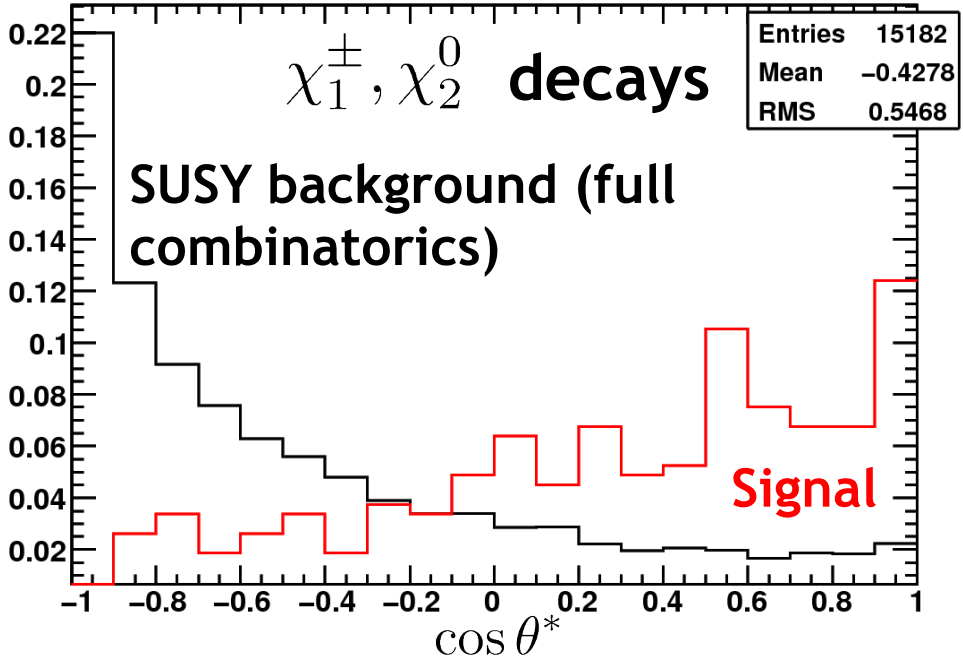
- Huge combinatorial background → Large invariant mass combinations, e.g.



- In rest frame of SUSY particles: angular distribution $\cos\theta^*$ of decay products with respect to flight direction of decaying particle should be ~isotropic (for spin 0)
- $\cos\theta^*$ for typical background 4-vector configurations of are not uniformly distributed (smaller angles preferred)



Many decay angles in SUSY cascades
→ **Use event kinematics to reduce combinatorial bg reduction**



Angular Relations in Fitness Function

Take Likelihood functions for signal (background) from generator information (fit results)

Likelihood ratio: $\mathcal{L} = \frac{L_{\text{signal}}}{L_{\text{signal}} + L_{\text{bg}}}$

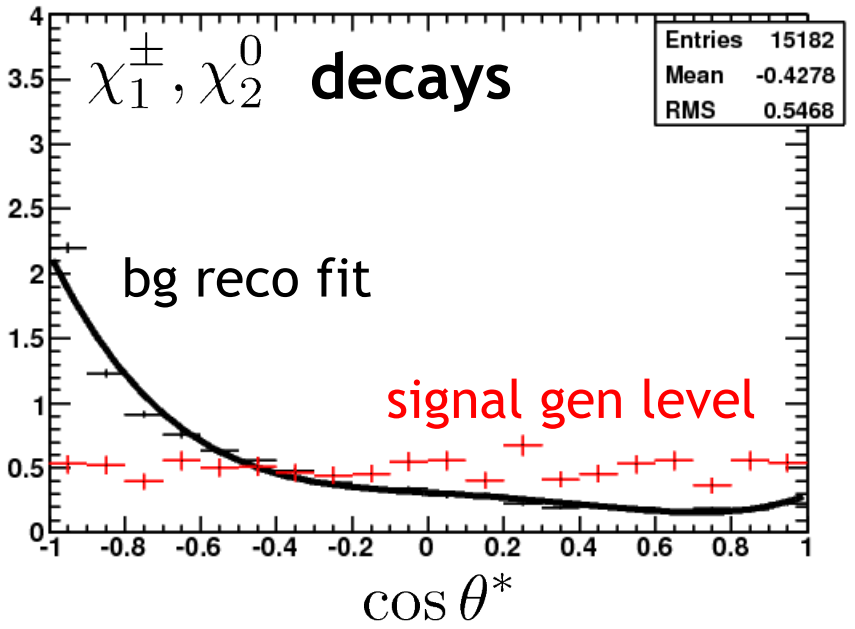
Relation between χ^2 and likelihood

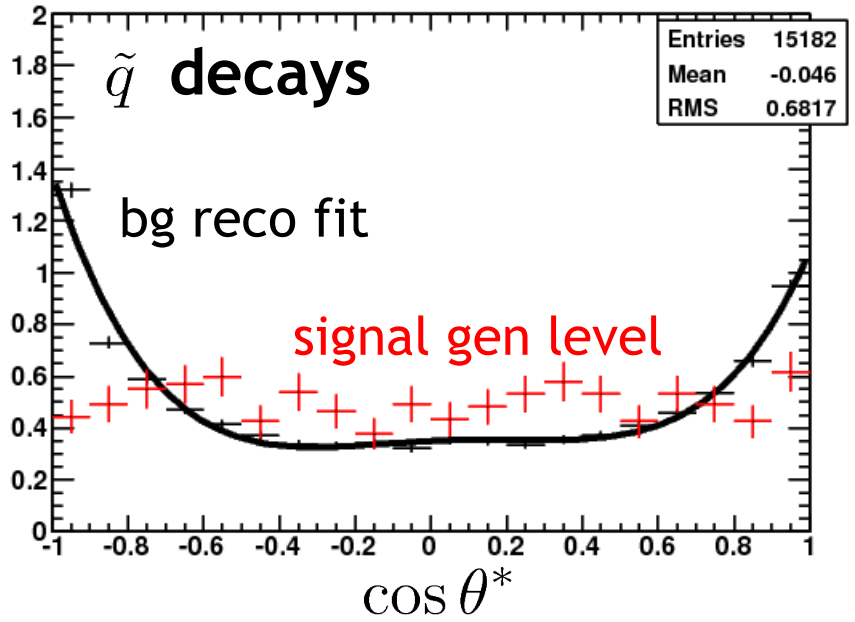
$$\mathcal{L} = \exp\left(\frac{-\chi^2}{2}\right)$$

$$\rightarrow \chi^2 = -2 \cdot \log \mathcal{L}$$

Two squark and two chargino/neutralino decays yield four new contributions to fitness function

Potential problem: signal is ~ uniformly distributed, but now particular regions are preferred → some signal events more converge with wrong combination





Status and Plans

- Mass edges do not provide new information in addition to mass constraints
- Study how angular relations reduce background from SUSY background
- Use angular information after the fit (can then also be used with Lagrangian multipliers)
- Look at different χ^2 contributions to get a feeling which constraints are most sensitive on bg (combinatorial and SUSY bg)
- Study stability of the fit (repeat several times ... with different starting values ... different algorithm settings ...)
- Search for additional kinematic constraints/variables (e.g. $\Delta\phi$ of two primary SUSY particles)